Our evaluation of the five factors with respect to polar bear populations is presented below. We considered all relevant available scientific and commercial information under each of the listing factors in the context of the present-day distribution of the polar bear.

Factor A. Present or Threatened Destruction, Modification, or Curtailment of the Polar Bear's Habitat or Range

Introduction

As described in detail in the ''Species Biology'' section of this rule, polar bears are evolutionarily adapted to life on sea ice (Stirling 1988, p. 24; Amstrup 2003, p. 587). They need sea ice as a platform for hunting, for seasonal movements, for travel to terrestrial denning areas, for resting, and for mating (Stirling and Derocher 1993, p. 241). Moore and Huntington (in press) classify polar bears as an ''ice-obligate'' species because of their reliance on sea ice as a platform for resting, breeding, and hunting. Laidre et al. (in press) similarly describe the polar bear as a species that principally relies on annual sea ice over the continental shelf and areas toward the southern extent of the edge of sea ice for foraging. Some polar bears use terrestrial habitats seasonally (e.g., for denning or for resting during open water periods). Open water by itself is not considered to be a habitat type frequently used by polar bears, because life functions such as feeding, reproduction, or resting do not occur in open water. However, open water is a fundamental part of the marine system that supports seal species, the principal prey of polar bears, and seasonally refreezes to form the ice needed by the bears (see ''Open Water Habitat'' section for more information). In addition, the extent of open water is important because vast areas of open water may limit a bear's ability to access sea ice or land (see ''Open Water Swimming'' section for more detail). Snow cover, both on land and on sea ice, is an important component of polar bear habitat in that it provides insulation and cover for young polar bears and ringed seals in snow dens or lairs on sea ice (see ''Maternal Denning Habitat'' section for more detail).

Previous Warming Periods and Polar Bears

Genetic evidence indicates that polar bears diverged from grizzly bears between 200,000–400,000 years ago (Talbot and Shields 1996a, p. 490; Talbot and Shields 1996b, p. 574); however, polar bears do not appear in the fossil record until the Last Interglacial Period (LIG) (115,000–140,000 years ago) (Kurten 1964, p. 25; Ingolfsson and Wiig 2007). Depending on the exact timing of their divergence, polar bears may have experienced several periods of climatic warming, including a period 115,000–140,000 years ago, a period of warming 4,000–12,000 years ago (Holocene Thermal Maximum), and most recently during medieval times (800 to 1200 A.D.). During these periods there is evidence suggesting that regional air temperatures were higher than present day and that sea ice and glacial ice were significantly reduced (Circumpolar Arctic PaleoEnvironments (CAPE) 2006, p. 1394; Jansen et al. 2007, p. 435, 468). This section considers historical information available on polar bears and the environmental conditions during these warming periods.

During the LIG (115,000–140,000 years ago), some regions of the world including parts of the Arctic experienced warmer than present day temperatures as well as greatly reduced sea ice in some areas, including what is now coastal Alaska and Greenland (Jansen et al. 2007, p. 453). CAPE (2006, p.1393) concludes that all sectors of the Arctic were warmer than present during the LIG, but that the magnitude of warming was not uniform across all regions of the Arctic. Summer temperature anomalies at lower Northern Hemisphere latitudes below the Arctic were not as pronounced as those at higher latitudes but still are estimated to have ranged from 0–2 degrees C above present (CAPE 2006, p. 1394). Furthermore, according to the IPCC, while the average temperature when considered globally during the LIG was not notably higher than present day, the rate of warming averaged 10 times slower than the rate of warming during the 20th century (Jansen et al. 2007, p. 453). However, the rate at which change occurred may have been more rapid regionally, particularly in the Arctic (CAPE 2006, p. 1394). While the specific responses of polar bears to regional changes in climate during the LIG are not known, they may have survived regional warming events by altering their distribution and/or retracting their range. Similar range retraction is projected for polar bears in the 21st century (Durner et al. 2007). However, the slower rate of climate change and more regional scale of change during the LIG suggest that polar bears had more opportunity to adapt during this time in comparison to the current observed and projected relatively rapid, global climate change (Jansen et al. 2007, p. 776; Lemke et al. 2007, p. 351).

The HTM 4,000–12,000 years ago also appears to have affected climate Arctic-wide, though summer temperature anomalies were lower than those that occurred during the LIG (CAPE 2006, p. 1394). Kaufman et al. (2003, p. 545) report that mean surface temperatures during the HTM were 1.6 ± 0.8 degrees C (range: 0.5–3 degrees C) higher in terrestrial habitats and 3.8 ± 1.9 degrees C at marine sites than present-day temperatures at 120 sites throughout the western Arctic (Northeast Russia to Iceland, including all of North America). Furthermore, Birks and Amman (2000, pp. 1,392–1,393) provide evidence that change in some areas may have been rapid, including an increase of 0.2–0.3 degrees C per 25 years in Norway and Switzerland. However, the timing of warming across the Arctic was not uniform, with Alaska and northwest Canada experiencing peak warming 4,000 years prior to northeast Canada (Kaufman et al. 2004, p. 529). Thus while regional changes in temperature are believed to have occurred, the IPCC concluded that annual global mean temperatures were not warmer than present day any time during the Holocene (Jansen et al. 2007, p. 465). While polar bears did experience warmer temperatures in their range during this time, the regional nature of warming that occurred may have aided their survival through this period in certain areas. However, the degree to which polar bears may have been impacted either regionally or Arctic-wide is unknown.

The most recent period of warming occurred during the Medieval period (generally considered to be the period from 950 to 1300 AD). This episode again appears to have been regional rather than global (Broecker 2001, p. 1,497; Jansen et al. 2007, p. 469); additionally, temperatures during this period are estimated to be 0.1–0.2 degrees C below the 1961 to 1990 mean and significantly below the instrumental data after 1980 (Jansen et al. 2007, p. 469). Thus, temperatures and rate of change estimated for this time period do not appear comparable to present day conditions.

Unfortunately, the limited scientific evidence currently available to us for these time periods does limit our ability to assess how polar bears responded to previous warming events. For example, while genetic analyses can be useful for identifying significant reductions in population size throughout a species' history (Hedrick 1996, p. 897; Driscoll et al. 2002, p. 414), most genetic studies of polar bears have focused on analyzing